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DRAWINGS ATTACHED

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(54) DEREGISTERING CRIMP IN A CRIMPED MULTI FILAMENT TOW

(71) We, KIMBERLY-CLARK CORPORATION, a corporation organized under the laws of the State of Delaware, United States of America, of Neenah, Wisconsin, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a method and apparatus for deregistering crimped, continuous filament tow.

Textile tow may be made up of continuous, parallel, crimped, synthetically spun filaments, such as from 500 to 5,000,000 filaments, and may be prepared by grouping in parallel relationship the filaments spun from a plurality of spinnerette holes. The individual filaments or groups of filaments may be crimped before being combined, but the preferred method of making such crimped tow is to first form the tow and then run it through a crimping device.

The crimped tow may be used for many purposes in the form of continuous filaments without being cut into staple form; and, in this case, the continuous filaments generally are much more useful if they have an open structure in which large numbers of filaments are spaced from adjacent filaments and if the spacing is such that there is a uniform distribution of filaments transversely of the tow. One reason for crimping the filaments is so that when the crimps are deregistered, they provide the internal pressure in the tow for causing the tow to expand transversely, in order to make a wide web having an even distribution of filaments transversely. It is nearly impossible to cause the uniform spreading of straight filaments; and, the more crimps that are in the tow, the better is the distribution of filaments when the crimps are deregistered and the tow is in a tension relaxed condition. The crimped tow when it comes from the manufacturer has waves in it which are in register, so that the surface of it looks much like the wave in water, but when the crimps in the tow are deregistered, the crimps have a knuckle to knuckle contacting relation and balloon the tow out into a much greater width.

In a method of deregistering crimped tow in accordance with the invention, the crimped multi-filament tow is longitudinally pulled over a plurality of stationary bars under tension, moving other bars in contact with the tow after it has left said stationary bars in a direction opposite to the direction of movement of the tow, and subsequently passing the tow in pressure contact with a drafting roll while rotating the drafting roll at a slower speed than the speed of movement of the tow. Initial deregistration of the crimped filaments is obtained by the frictional effect of the tension bars on the tow while the tow is held under tension, tending to straighten out the crimps in the tow. The subsequent beating step provides additional deregistration of the crimped filaments while the filaments remain under tension. The first pair of rolls preferably include a resilient surfaced roll having a pressure nip with a fluted steel roll and the tow is pulled through this pressure nip by the second pair of rolls so that the fluted roll of the first pair has a brushing or wiping action on the bundle of tow causing additional deregistration of the crimps in the tow.

An embodiment of apparatus in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a plan view of the apparatus for deregistering crimped filamentary tow;

Figure 2 is a side elevational view of the apparatus; and

Figures 3 and 4 are sectional views taken on lines 3—3 and 4—4 of Figure 1.

Referring to the drawings, the apparatus for deregistering tow comprises generally a tension bar section 10, a beating section 11 and a drafting section 12.

The tow 13 to be processed by the apparatus

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of the invention may be withdrawn from any suitable tow container 14, and the apparatus may include an inclined chute 15 over which the tow is drawn from the container 14.

The tow 13 passes from the chute 15 to the tension bar section 10, and the tension bar section comprises bars 16 to 24. The bars 16 to 24 are supported from a support frame 25, the bars after 16 being supported in pairs. The bar 16 is disposed between a pair of opposite arms 26 and 27, and these arms are fixed to opposite vertical struts 28 and 29 that in turn are fixed to the frame 25. The bars 17 and 18 are supported as a pair between the opposite ends of arms 30 and 31, and these arms are fixed to opposite vertical struts 32 and 33 that are in turn fixed to the frame 25.

The bars 19 and 20, the bars 21 and 22 and the bars 23 and 24 are also supported in pairs from the frame 25 in the same manner as are the bars 17 and 18; namely, by means of arms 30a, 30b and 30c on one side of the frame 25; arms 31a, 31b and 31c on the other side of the frame 25; vertical struts 32a, 32b and 32c on one side of the frame 25; and vertical struts 33a, 33b and 33c on the other side of the frame.

The tow 13 passes consecutively over and under the tension bars 16 to 24 in the direction indicated by the arrow A. It will be observed from Fig. 2 that the arms 30 and 31 and therefore, the bar 18 with respect to the bar 17, are declined at about an angle of 35° in the direction A measured from the plane of the frame 25; the arms 30a and 31a and therefore, the bar 20 with respect to the bar 19, are declined about 10° in the direction A measured from this plane; the arms 30b and 31b and therefore, the bar 22 with respect to the bar 21, are declined at about an angle of 50° measured from this plane; and the arms 30c and 31c and therefore, the bar 24 with respect to the bar 23, are declined at about an angle of 20° measured from this plane. The tow is drawn from the chute 15 and passes initially over and in contact with the tension bar 16. The tow then contacts and passes over the bar 17 and under the bar 18, over the bar 19 and under the bar 20, over the bar 21 and under the bar 22 and over the bar 23 and then finally under the bar 24.

The beating section 11 comprises a plurality of bars 34a, 34b, 34c and 34d extending between the outer peripheral edges of a pair of discs 35 and 36 so as together to form a cage. The discs 35 and 36 are rotatably supported within a frame 37 and are driven from any suitable prime mover, such as the motor 38 and transmission unit 39, whereby the discs 35 and 36 and bar 34a to 34d rotate in the direction indicated by the arrow B.

The drafting section comprises a steel roll 40 having a nip with a rubber roll 41 and a pair of steel rolls 42 and 43. As will be observed, particularly from Figs. 3 and 4, the rolls 40, 42 and 43 have longitudinally extending flutes on their external surfaces, and the flutes of the rolls 42 and 43 intermesh. The rolls 40 to 43 are rotatably disposed in a frame 44, and any suitable driving apparatus and gearing 45 may be provided for driving the roll 40 at a relatively slow speed and for driving the roll 42 and thereby the roll 43 at a higher speed.

In operation, the tow from the tow container 14 is drawn over the chute 15, over and under the various tension bars 16 to 24, over the bars 34a to 34d of the beating section 11 and through the nip of the rolls 40 and 41 by the action of the rolls 42 and 43 which act as pull rolls. The tow thus is under some tension as it passes through the tension bar section 10, and the tension in itself has the function of not only straightening out the crimps in the filaments somewhat but also of moving some of the crimps in the tow filaments out of register, particularly on subsequent relaxations of tension as occur a number of times for each revolution of the discs 35 and 36 in the beating section 11 and as also occur to some extent in the tension bar section 10 subsequent to the bar 16 and subsequent to each of the tension bar pairs 17—18, 19—20, etc. The tow as it passes over each of the tension bars 16 to 24 also has its crimps deregistered due to the friction between the filaments of the tow and each of the tension bars. Each of the tension bars is in frictional contact with only some of the filaments in the tow; and, therefore, there is a skating action or relative movement of the particular filaments in contact with the tension bar with respect to the other filaments in the tow that are not in contact with the particular tension bar. It will be noticed that some of the tension bars 16 to 24 are in contact with the upper surface of the tow while others are in contact with the lower surface of the tow; and, therefore, the bars are in contact with different filaments as the filaments proceed over the tension bars due to this reason. Also, the filaments tend to shift in the tow, moving from external surfaces of the tow to inside the tow as the tow moves through the tension bar section 10; and, for this additional reason, the various tension bars are in contact with different filaments as the tow passes over the tension bars so that frictional retardation on different ones of the filaments is exerted by the different tension bars, causing deregistration of crimps due to this action also. An additional crimp deregistering action of the tension bars is due to the fact that the tow has a substantial thickness as it passes over each of the tension bars; and, therefore, the filaments on the outside, away from the surface of the particular tension bar over which the tow is passing, passes around the bar at a greater radius than the filaments closer to the center of the tension bar. There thus is a difference in speed of the filaments due to the different radii at